

Unraveling the Mysteries of Armpump

By Jondy L. Cohen, M.D.

A debilitating condition is limiting the performance of some of the world's top athletes. This condition affects competitors regardless of age, sex, or race, and varies in severity from slightly annoying to downright dangerous. "Chronic Exertional Compartment Syndrome of the Forearm," the most common cause of "arm pump," lacks large foundations, celebrity spokesmen or other sources of funding, and therefore little research is conducted on the subject.

Although the world's governments are not racing to cure arm pump, the MXA wrecking crew wants to help you sort fact from fiction, opinion from knowledge, and quackery from cure. To achieve this, we contacted Dr. Jondy L. Cohen, a practicing Orthopedic Surgeon in Northern California, to define the current status of arm pump.

REVIEWING THE LITERATURE

Although every motocrosser is familiar with arm pump, it is unlikely that your doctor is. Dr. Cohen extensively reviewed the medical literature and found almost nothing on the subject. In the "American Journal of Sports Medicine" in 1998, one author even states that "Chronic compartment syndromes of the upper extremity are rare, and only a few cases have been reported in the literature."

A casual sampling of sports medicine professionals revealed only a small fraction who were familiar with the disorder. Conversely, almost every motocross racer is not only familiar with the condition, but also aware of the existence of a surgical treatment to help alleviate it (and usually several nonoperative treatments). The fact that Stephane Roncada, Justin Buckelew, John Dowd and Brock Sellards have recently undergone arm pump surgery has heightened interest in this condition among motorcycle racers.

IN SEARCH OF A QUICK FIX

Riders suffering from arm pump often look for an easy solution. These riders don't want to put much effort into understanding the problem and would prefer a quick fix (be it an operation, medication or corrective therapy). Americans have become used to easy, drive-thru, technologically advanced solutions to all of life's problems, so it is not surprising that we expect an HMO-covered, FDA-approved, computer-controlled, laser-guided medical solution to arm pump.

Unfortunately, the best way for you to treat your arm pump is to understand its causes. Arm pump is no different than jetting or suspension problems—it can't be solved by a simple one-sentence answer. Forearm pain that occurs while

riding is not always due to arm pump. Riders with carpal tunnel syndrome, ganglion cysts, arthritis, neck abnormalities, tennis elbow and fractures all suffer forearm pain while riding. However, in the interest of brevity, we will only discuss arm pain due to Chronic Exertional Compartment Syndrome of the Forearm (CECSF).

Please remember, the MXA test crew is bereft of medical degrees, and Dr. Cohen cannot diagnose from afar, so this article cannot substitute for a good physical exam by a physician.

THE HEARTBREAK OF ARM PUMP

Severe arm pump can ruin a great day. A talented racer may meticulously prepare his bike, spend thousands of dollars on equipment, endure countless hours of practice and feel as though he is ready, only to have his forearms pump up on lap three. All that money, time and effort can't stop the rider's hands from becoming useless.

Not all cases of arm pump are severe. Riders often complain that they can practice all week without arm pump only to pump up on Sunday. Symptoms usually occur at the palm (volar) side of the forearm rather than the back (dorsal) side. The tension of the race, increased heart rate of the activity and the infamous death grip contribute to a small amount of arm pump in most riders. This numbness or tingling in the forearm and hand can occur on especially bumpy tracks, muddy days or on tracks with hard braking zones. Fortunately, the symptoms of this type of arm pump are temporary and hand function quickly returns after a short rest.

Normally, a rider will pump up in the first moto, but not in the second. This is partially due to muscle memory, lessened anxiety and increased blood flow. It is important to note that a small amount of arm pump is acceptable. Suffering from arm pump does not make you an instant candidate for arm pump surgery. Before you even consider arm pump surgery, you should alter your riding style, bike setup and training habits.

ACUTE COMPARTMENT SYNDROME IS NOT ARM PUMP

What if your forearms pump up and the pump doesn't go away after you stop riding? Not good. Persistent symptoms, that do not reduce between motos, are worrisome and may indicate you have developed "Acute Compartment Syndrome." Unlike normal, acceptable arm pump (the chronic form) discussed above, symptoms of Acute Compartment Syndrome increase even after resting. The acute form usually results from an injury, but may occur after strenuous exercise. Acute Compartment Syndrome is a true emergency and may lead to permanent muscle damage unless surgically treated in less than six hours.

Larry Brooks suffered the most famous case of Acute Compartment Syndrome. Larry crashed at the '94 San Jose Supercross and his right arm began to swell instantly. By the time he reached the hospital, the swelling was so extreme that the blood flow to his hand and fingers was in danger of being cut off. Doctors told Larry that if they didn't act immediately, they might be forced to amputate his arm. Luckily, surgeons cut his fascia, thus reducing the pressure and restoring blood flow to the muscle. After a long recovery, Brooks returned to racing. Thus, be forewarned: if you cannot move your fingers 15 minutes after you stop riding, you should be concerned and perform the following test.

The test: Have a friend move your fingers for you in both directions (flexion and extension). If this maneuver results in severe pain, go to a doctor. If your pain continues or increases long after you've stopped riding, seek medical attention at once! If you think you have Acute Compartment Syndrome, don't assume it's just arm pump—unless you like the moniker Lefty.

THE IMPORTANCE OF THE FASCIA

Muscles are often found together in "fascial compartments." Fascial compartments contain muscle wrapped in a layer of "fascia." Fascia is a tough, but thin, white gristle that envelops the compartment like a casing wraps a sausage. Fascia helps to anchor muscles and give them form. Fascia is very strong, but it is not very elastic. The inelasticity of fascia surrounding muscle means that even small increases in the volume of a fascial compartment can cause large pressure increases within the compartment.

FOREARM DESIGN

The forearm has two sides, the palm side (called the "volar" side), and the backside (called the "dorsal side"). The muscles on the palm side of the forearm bend (flex) the fingers and wrist. The muscles on the backside of the forearm straighten (extend) the fingers and wrist. When you grab your bars, notice how the muscles on both sides of the forearm tighten. The palm muscles are bending your fingers to grip the bars and the backside muscles are holding your wrist stable.

HOW ARM PUMP HAPPENS

During vigorous exercise, muscles require a tremendous amount of oxygen-rich blood and commonly increase in volume by up to 20 percent. The engorged muscle is encased inside the inelastic fascia and, as it grows, the pressure within the fascia compartment increases. Although gases and solids are compressible, fluids are not. The incompressible fluid within the inelastic fascia makes the forearm feel hard as rock. If the "compartment pressure" rises high enough, blood vessels can collapse, which restricts or stops the flow through that vessel. Veins, with their low pressure and thin walls, collapse earlier than high-pressure, thick-walled arteries. When venous flow reduces,

arterial blood continues to enter the fascial compartment but is restricted from leaving. This restricted outflow further increases the pressure within the fascia compartment. If the compartment pressure rises higher than the pressure in the capillaries, or even the arteries, then these vessels may collapse, resulting in "muscle ischemia"—a painful condition of oxygen deprivation. Muscle ischemia leads to even higher compartment pressures. Most of the studies related to high compartment pressure (what motocrossers know as arm pump) have been documented in the lower legs of distance runners. Only a few cases have been described in the hands, feet, thigh, elbow, and forearm. The condition is called various names, including "chronic compartment syndrome," "effort-related compartment syndrome," "exercise-induced compartment syndrome," or "chronic exertional compartment syndrome." Motocross arm pump is technically known as "chronic compartment syndrome of the forearm," (CCSF). All of the names seek to differentiate this condition from the much more dangerous condition of "acute compartment syndrome" (the kind Larry Brooks had). WHAT DOCTORS DON'T KNOW

Despite the limitations of medical literature, we all know that chronic compartment syndrome of the forearm in motocrossers is common. Probably more common than chronic compartment syndrome of the leg in long distance runners.

Why is it more common? The higher incidence in motocross is related to the fact that forearm muscles only get blood flow during relaxation. NASA performed a study of forearm muscle blood flow in 1996. While studying normal volunteers they found "... a significant reduction in muscle oxygenation even at levels as low as 10 percent maximal contraction." This explains why we pump up less when we relax, move our fingers and unclench our hands. Thus, we pump up more on race day because forearm muscles only get blood flow when they are relaxed--and they aren't that relaxed while racing.

NONOPERATIVE SOLUTIONS TO ARM PUMP

Dr. Cohen's research for MXA centered on finding recommendations for lessening arm pump--ranging from scientifically accurate to downright bizarre. Since little true research about arm pump exists, very few of motocross' homegrown remedies have really been tested. Remember that if someone says that after they did X then Y happened, it does not necessarily mean that Y was a result of X. On the other hand, the mind is a very poorly understood and powerful organ. True belief in a treatment often has remarkably good results, a well-documented phenomenon called the placebo effect. Thus if one rider claims that soaking his forearms in ice before a moto works, as Jeff Ward used to do, then many riders will use and believe in this method (even if it has no scientific foundation). Nonoperative arm pump solutions can be broken into three categories (based on their chance of success in reducing arm pump for a large population). MXA's list does not mean that other techniques won't work

for you as an individual, but these are the strategies that will have the greatest effect on the largest number of riders.

STRATEGY ONE: ALTER YOUR RIDING STYLE

Altering your riding style has a good chance of reducing arm pump in riders who suffer from the problem. It requires three steps:

1. Frequent riding. The more you ride, the more efficient your body becomes at delivering blood to the forearms and, more importantly, transporting the waste material out of your forearms.
2. Staying relaxed on the track. By loosening your stranglehold on the grips, moving your fingers, and alternating between squeezing and relaxing your hands, you can keep blood flowing.
3. Use your legs. If you grip the bike with your knees, you reduce the amount of upper body strength required to hold on. The muscles of the leg are larger and less likely to pump up than the muscles of the forearm, so shifting the load will help.

STRATEGY TWO: CHANGE YOUR WORKOUT

If you train regularly, perhaps changing your training pattern can help reduce arm pump. Realistically, changing your training regime has a medium chance of reducing arm pump. Here are MXA's four training tips: 1. Avoid heavy weights in arm workouts.

2. Emphasize wrist curls with light weights and high repetitions.
3. Do lots of forearm and wrist stretching.
4. Use aspirin as a blood thinner. The blood thinning attributes of aspirin work best in low doses. One pill a day is all you need.

While studies have not proven that proper hydration can reduce arm pump, it is logical to assume that being dehydrated could lead to or increase the chance of pumping up. Drink plenty of water before and after every event. Kevin Windham claims he drinks at least a gallon a day.

STRATEGY THREE: THE SCATTERSHOT APPROACH

Arm pump can come from a variety of different sources. Although your chances of eliminating arm pump with these tips is slim, you never know. Here are areas of concern for any racer:

1. Try taking nutritional supplements, vitamins, magnesium, potassium and calcium. These can help alleviate chemical imbalances.
2. Change your bar bend, composition (aluminum) or position (some say up, some say down).
3. Alter your lever position (some say up, some say down).
4. Try different grip sizes and densities (some say smaller and stiffer grips helped, while others say a larger and softer grip absorbs vibration better).
5. Steering dampers, like the Scotts and WER, can lessen your death grip.
6. Gripper seat covers allow you to maintain your position on the bike with less arm strength.
7. Acupuncture, magnetic therapy and crystals could work on a psychological level.

THE TRUTH ABOUT ARM PUMP SURGERY

What about arm pump surgery? After all, Buckelew, Roncada, Sellards and Dowd had it done. Can surgery end arm pump? Surgical release of the forearm fascia (fasciotomy) is easily performed by an Orthopedic Surgeon. Fasciotomy is not a new or difficult procedure, and is more commonly performed in the leg than the forearm. It is often performed in trauma patients to treat or prevent acute compartment syndrome (a la Larry Brooks).

By cutting the skin and then slicing the muscle's fascia (or actually removing a strip of fascia) the gristle-like compartment is opened up. This gives the muscles of the forearm room to expand. Your forearm has four fascial compartments, and it takes two incisions to release all four. The first is a volar incision to release the superficial and deep volar compartments. The second cut is a dorsal incision to release the dorsal and mobile wad compartments.

The use of forearm fasciotomy for arm pump is very poorly documented in the medical literature. In the few studies that have been written up, the authors contradict one another on several points, including what constitutes abnormal compartment pressures and which compartments should be released.

IT'S NOT CUT AND DRIED

Some doctors believe that a resting compartment pressure over 20 mm/Hg is diagnostic for this condition. Others maintain that an exertional pressure 30mm/Hg below the diastolic blood pressure is important. While still others think resting pressures greater than 25mm/Hg measured five minutes after exertion is diagnostic.

Similar disagreement exists on which compartments need releasing. Some doctors release all four fascia compartments while others only release those compartments with elevated pressures. Still others only release the volar compartments. Some of this confusion stems from the fact that the more commonly operated-on leg fascial compartments have very little interconnection and therefore complete fascial release requires release of all compartments.

However, in the forearm there is good evidence showing that compartments are often interconnected and effective release can be accomplished by releasing just the volar compartments. No matter which compartments are released, the operation can be done as an out-patient procedure (no need for an overnight stay). A cast isn't necessary and recovery time is brief. Training can start about two to three weeks after surgery, and a rider can return to competition in four to six weeks.

THE BOTTOM LINE

Arm pump surgery is a hot-button treatment. It has pizzazz and endorsements from riders who have tried it. But it should be used as a last resort. Stephane Roncada is the poster boy for arm pump surgery. He believes that it changed his career—and there is no doubt that his results improved after the surgery. On the other hand, Brock Sellards had it done before the start of the 2001 Supercross season and suffered worse arm pump. Sellards has undergone additional operations to try to fix the problem. Before you try to solve your arm pump problems with surgery, try all the changes to your riding style and training that we've recommended. If you can't find any relief, you might then be a candidate for surgical release of your forearm fascia. Remember, not all patients improve with fascial release. Many European riders claim that the effects of arm pump surgery seem to wear off after the first season. Have your doctor measure compartment pressures after riding to determine which compartments to release. Surgery is a serious option and it does not come without risks. There is always the chance of complications.

USE YOUR HEAD, NOT YOUR ARMS

Arm pump surgery makes sense. If the muscles are pumped up, why not cut open their compartments and give them room to expand? Good question. The answer is not as simple. Most riders don't need surgery to control their arm

pump. They ride relaxed, they have an effective training program, their diet is well balanced and their genetics are such that they don't get pumped. Others are not so lucky. There are a small number of riders who, no matter what they do, are going to pump up. Surgery will be the only arm pump solution for this group. These riders need to have their arm's fascial compartments measured properly and evaluated by a surgeon. The surgeon can then determine the exact compartments that need to be released.

Article taken from www.motocrossactionmag.com You can contact Jondy L. Cohen, M.D. at arm_pump@yahoo.com to possibly participate in a non-operative study on the causes of pump.